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Research Interests

My research interests include (1) understanding the ocean's role in the global climate system, (2) formulating physically and mathematically sound subgrid-scale parameterizations for ocean dynamics, especially those related to ocean mesoscale eddies, (3) developing robust and efficient numerical algorithms for ocean circulation models, (4) articulating the fundamentals of ocean climate models, and (5) studying methods for quantifying predictability and using these methods to understand climate variability.

Research Themes

An overall goal of my research and development work is to contribute to the evolution of ocean climate modeling into a rationally driven scientific endeavor. This, as well as my training in theoretical physics, motivates me to approach research from fundamental physical, mathematical, and numerical perspectives, and to present work in a pedagogical manner. More precisely, my work can be split into two main areas: the design, construction, and support of numerical ocean climate models, and the use and analysis of climate model simulations. There is a synergy between model building and model use, and such provides an underlying theme to my research.

Computer models that simulate the ocean are the main tool scientists use to address large-scale ocean climate questions. These questions have relevance over a broad range of issues, from curiosity driven research to policy relevant forecasts. My work has resulted in papers of notable impact, such as those focusing on subgrid-scale parameterizations. It has also led me to become the intellectual force behind the Modular Ocean Model (MOM), which is a model used by ocean climate scientists worldwide. Finally, this work has motivated me to compose a monograph on the fundamentals of ocean climate models. This book aims to provide the modeling community, especially its students, with a thorough pedagogical discussion of what it takes to formulate and to build an ocean climate model.

My use of ocean climate models has thus far emphasized the large-scale circulation, especially that in the North Atlantic. Out of this work came the first systematic study of simulated North Atlantic predictability, as well as novel methods for quantifying climate predictability. I am presently involved in projects aiming to diagnose and understand differences between global climate simulations achieved with various high-end models. Understanding differences between model simulations, and providing methods for achieving systematic comparisons, is a critical and nontrivial goal of ocean climate modelers, especially as simulations become more widely used as the basis for government policy.

Leadership Responsibilities at GFDL

I have been a leader in GFDL's ocean climate modeling efforts since the late 1990's. This work has most recently involved my providing intellectual and management leadership for the development of the ocean component to GFDL's coupled earth system model, whose main use is for studying and quantifying human effects on climate. As leader of GFDL's Oceans and Climate Group, I am responsible for developing research agendas of the group, as well as for the recruitment of research scientists for sabbatical visits and/or hires onto our full-time staff. Finally, as a key representative of GFDL's ocean research and development efforts, I am responsible for setting up collaborative projects, and in providing leadership in the international ocean climate science community.

Employment

2001–present	**GFDL Oceans and Climate Group Leader**
2001–2002	**GFDL Ocean Model Development Team co-leader**
2000–2001	**GFDL Climate Model Development Team Leader**
2000–present	**GFDL Physical Scientist, Grade GS-14**
1997–2000	**GFDL Physical Scientist, Grade GS-13**
1996–1997	**GFDL Physical Scientist, Grade GS-12**
1995–1996	**GFDL Visiting Research Scientist**
1993–1995	**UCAR Global & Climate Change Fellow at Princeton University**
1988–1993	**University of Pennsylvania Physics Graduate Research Fellow**
1984–1986	**Louisiana State University Chemical Engineering Research Technician**

Education

1988–1993	**University of Pennsylvania** Doctoral student in theoretical physics (Ph.D. June 1993)	**Philadelphia, USA**
1987–1988	**University of Washington** Physics undergraduate student	**Seattle, USA**
1986–1987	**Northwestern University** Masters student in applied mathematics (M.S. June 1987)	**Evanston, USA**
1981–1986	**Louisiana State University** Undergraduate student in chemical engineering (B.S. June 1986)	**Baton Rouge, USA**

Teaching Experience

1993	**Co-Lecturer: Atmospheric and Oceanic Data Assimilation**, Princeton University
1990–1993	**Instructor: Undergraduate Physics Laboratory**, University of Pennsylvania
1990–1993	**Teaching Assistant: General Relativity and Quantum Field Theory**, University of Pennsylvania

Oceanographic Cruises

1993	**Technical Assistant**: WOCE Line AR7W / Atlantic Circulation Experiment, Labrador Sea, *CCGS* Hudson (John Lazier, Chief Scientist)

Awards

2001	**NOAA/Oceanic and Atmospheric Research Outstanding Scientific Paper**
1999	**NOAA/Oceanic and Atmospheric Research Outstanding Scientific Paper**
1998	**NOAA/Oceanic and Atmospheric Research Employee of the Year**
1997	**NOAA/Environmental Research Laboratories Outstanding Scientific Paper**

Professional Societies and Committees

Member of the American Geophysical Union (since 1993)

Member of the American Meteorological Society (since 1993)

Co-author: Intergovernmental Panel on Climate Change-2001, sections on climate predictability (with Tim Palmer) and ocean climate modeling (with Peter Gent and Claus Böning)

Member of the World Climate Research Programme (WCRP) and World Ocean Circulation Experiment (WOCE) Working Group on Ocean Model Development

Key workshops and invited lectures

May 2003	Invited lecturer for the workshop "Australian ocean climate modeling", Hobart, Australia.
May 2002	Invited lecturer for the workshop "German ocean climate modeling", Kiel, Germany.
Aug 2002	Co-organizer (with Alistair Adcroft) for the meeting "Z-coordinate Ocean Modeling", Massachusetts Institute of Technology, Cambridge, Massachusetts.
Jan 2001	Three invited lectures on Ocean Dynamics and Modeling, La Escuela de Verano de Universidad de Concepción, Chile.
Nov 1999	Organizer for the meeting "Z-coordinate Ocean Modeling at GFDL, LANL, MIT, and NCAR", Princeton.
Mar 1999	Two invited lectures on ocean and climate modeling at the Conference on Global Climate, Barcelona, Catalunya, Spain.
Jul 1999	Co-chair (with Shoshiro Minobe) of the International Union of Geodesy and Geophysics Session on Ocean/Atmosphere Variability and Predictability, Birmingham, England.
Jan 1998	NATO Advanced Study Institute: Ocean Modeling and Parameterization (Les Houches, France).
Jan 1996	NATO Advanced Study Institute: Climate Variability and Predictability (Les Houches, France).
Jul 1994	Meeting of UCAR Global and Climate Change Fellows (Steamboat Springs, USA).

Jul 1992	Theoretical Advanced Study Institute: "From String Theory to Black Holes" (Boulder, USA).
Jul 1991	High Energy Physics and Cosmology Summer School (Center for Theoretical Physics, Trieste, Italy).
Jun 1991	Theoretical Physics Summer School: "Particle Physics in the 1990's" (Les Houches, France).

Geophysics publications and works in progress

1. Updated algorithms for density, potential temperature, conservative temperature and freezing temperature of seawater, 2004: D. R. Jackett, T. J. McDougall, R. Feistel, D. G. Wright, and S. M. Griffies. In preparation.

2. Impacts of shortwave penetration depth on large-scale ocean circulation and heat transport, 2004: S. Sweeney, A. Gnanadesikan, S. M. Griffies, M. J. Harrison, A. J. Rosati, and B. L. Samuels. Submitted to *Journal of Physical Oceanography*.

3. **Fundamentals of Ocean Climate Models**, 2004: S.M. Griffies. In press with *Princeton University Press*. Princeton, USA.

4. **A Technical Guide to MOM4**, 2004: S.M. Griffies, M. J. Harrrison, R.C. Pacanowski, and A. Rosati, NOAA/Geophysical Fluid Dynamics Laboratory Technical Report No. 5. Princeton, USA.

5. An Introduction to Linear Predictability Analysis, 2003: S.M. Griffies. In **Global Climate: Current Research and Uncertaintites in the Climate System**. X. Rodo and R. A. Comín, editors. Springer.

6. An Introduction to Ocean Climate Modeling. 2003: S.M. Griffies, In **Global Climate: Current Research and Uncertaintites in the Climate System**. X. Rodo and R. A. Comín, editors. Springer.

7. Physical climate processes and feedbacks. In **Climate Change 2001: Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change**, 2001: T.F. Stocker, G. K. C. Clarke, H. Le Treut, R. S. Lindzen, V. P. Meleshko, R. K. Mugara, T. N. Palmer, R. T. Pierrehumbert, P. J. Sellers, K. E. Trenberth, J. Willebrand, R. B. Alley, O. E. Anisimov, C. Appenzeller, R. G. Barry, J. J. Bates, R. Bindschadler, G. B. Bonan, C. W. Bning, S. Bony, H. Bryden, M. A. Cane, J. A. Curry, T. Delworth, A. S. Denning, R. E. Dickinson, K. Echelmeyer, K. Emanuel, G. Flato, I. Fung, M. Geller, P. R. Gent, S. M. Griffies, I. Held, A. Henderson-Sellers, A. A. M. Holtslag, F. Hourdin, J. W. Hurrell, V. M. Kattsov, P. D. Killworth, Y. Kushnir, W. G. Large, M. Latif, P. Lemke, M. E. Mann, G. Meehl, U. Mikolajewicz, W. O'Hirok, C. L. Parkinson, A. Payne, A. Pitman, J. Polcher, I. Polyakov, V. Ramaswamy, P. J. Rasch, E. P. Salathe, C. Schr, R. W. Schmitt, T. G. Shepherd, B. J. Soden, R. W. Spencer, P. Taylor, A. Timmermann, K. Y. Vinnikov, M. Visbeck, S. E. Wijffels, and M. Wild. Cambridge, UK: Cambridge University Press, 418-470.

8. Tracer Conservation with an Explicit Free Surface Method for Z-coordinate Ocean Models, 2001: S. M. Griffies, R.C. Pacanowski, M. Schmidt, and V. Balaji, *Monthly Weather Review*, **129**, 1081–1098.

9. Developments in Ocean Climate Modelling, 2000: S.M. Griffies, C. Böning, F.O. Bryan, E.P. Chassignet, R. Gerdes, H. Hasumi, A. Hirst, A.-M. Treguier, and D. Webb, *Ocean Modelling*, **2**, 123-192. **NOAA/Oceanic and Atmospheric Research Laboratories 2001 Outstanding Scientific Review Paper Award**.

10. Biharmonic friction with a Smagorinsky-like viscosity for use in large-scale eddy-permitting ocean models, 2000: S.M. Griffies and R. W. Hallberg. *Monthly Weather Review*, **128**, 2935–2946.

11. Spurious diapycnal mixing associated with advection in a z-coordinate ocean model, 2000: S.M. Griffies, R. C. Pacanowski, and R. W. Hallberg. *Monthly Weather Review*, **128**, 538–564.

12. **The MOM 3 Manual**, 1999: R. C. Pacanowski and S.M. Griffies. NOAA/Geophysical Fluid Dynamics Laboratory Technical Report No. 4. Princeton, USA.

13. A conceptual framework for predictability studies, 1999: T. Schneider and S.M. Griffies. *Journal of Climate*, **12**, 3133-3155.

14. The Gent-McWilliams Skew-Flux, 1998: S.M. Griffies, *Journal of Physical Oceanography*, **28**, 831-841.

15. Isoneutral diffusion in a z-coordinate ocean model, 1998: S.M. Griffies, A. Gnanadesikan, R. C. Pacanowski, V. Larichev, J. K. Dukowicz, and R. D. Smith, *Journal of Physical Oceanography*, **28**, 805–830. **NOAA/Oceanic and Atmospheric Research Laboratories 1999 Outstanding Scientific Paper Award**.

16. A Predictability Study of Simulated North Atlantic Multidecadal Variability, 1997: S.M. Griffies and K. Bryan, *Climate Dynamics*, **13**, 459–488.

17. Predictability of North Atlantic Multidecadal Climate Variability, 1997: S.M. Griffies and K. Bryan, *Science* **275**, 181–184. **NOAA/Environmental Research Laboratories 1997 Outstanding Scientific Paper Award**.

18. Reply to Comment on "Instability of the Thermohaline Circulation with Respect to Mixed Boundary Conditions", 1996: J. R. Toggweiler, E. Tziperman, Y. Feliks, K. Bryan, S.M. Griffies, and B. Samuels, *Journal of Physical Oceanography*, **26**, 1106–1110.

19. A Linear Thermohaline Oscillator Driven by Stochastic Atmospheric Forcing, 1995: S.M. Griffies and E. Tziperman, *Journal of Climate*, **8**, 2440–2453.

Theoretical Physics publications

1. Local and Global Aspects of Domain Wall Space-times, (with M. Cvetič and H. H. Soleng), *Physical Review* **D 48**, 2613–2634 (1993).

2. Nonextreme and Ultraextreme Domain Walls and their Global Space-Times, (with M. Cvetič and H. H. Soleng) *Physical Review Letters*, **71**, 670–673 (1993).

3. Cauchy Horizons, Thermodynamics and Closed Time-like Curves in Planar Supersymmetric Space-times, (with M. Cvetič, R. Davis, and H. H. Soleng) *Physical Review Letters*, **70**, 1191–1194 (1993).

4. Domain Walls in $N = 1$ Supergravity, (with M. Cvetič) in **The Proceedings of the International Symposium on Black Holes, Membranes, Wormholes, and Superstrings**. (S. Kalara and D. Nanopoulos editors), World Scientific (1993).

5. Nonperturbative Stability of Supergravity and Superstring Vacua, (with M. Cvetič and S.-J. Rey), *Nuclear Physics* **B389**, 3–24 (1993).

6. Gravitational Effects in Supersymmetric Domain Wall Backgrounds, (with M. Cvetič), *Physics Letters* **285B**, 27–34 (1992).

7. Static Domain Walls in $N = 1$ Supergravity, (with M. Cvetič and S.-J. Rey) *Nuclear Physics* **B381**, 301–328 (1992).

8. Two Skyrmion Interaction for the Atiyah-Manton Ansatz, (with A. Hosaka, M. Oka, and R. D. Amado) *Physics Letters* **251B**, 1–5 (1990).